NVARC
Nashoba Valley
Amateur Radio Club

SIGNAL

May 1993 Volume 2 Number 5

This month at the NVARC meeting

QRP

When conditions are right, 100 mW can go anyplace that 1500 Watts can go. At the May 20th meeting, the subject is QRP -- some say the fastest growing part of the hobby. QRP. Join us and get the scoop.

The Elections (again...)

You gotta love this club.... Last month the April election got adjourned because nobody knew who was on the proposed slate of officers. This month the elections will proceed.

The proposed slate of candidates is:

President: Stan Pozerski
Treasurer: Ben Akins
Director: Clint Talmadge

The offices of Vice President and Secretary have no nominees Nominations will be accepted from the floor for these or any of the other offices.

Field Day

Storm and wind, sleet and rain;
I guess Field Day's back again.
Out amid the muck and mess
We're 2-Alpha, Eastern Mass.

Have I mentioned Field Day yet? Scheduled for the last full weekend in June (the 26th and 27th this year) Field Day is one of the great ham radio traditions. This being the second year that **NVARC** has been around, it will also be the second annual **NVARC** Field Day.

Since we have only the May and June meetings between now and then, we need to get some planning done. Come help plan the event, come help operate the event, come help with the logistics. In short, come help.

Last month at the NVARC meeting

Jim, WA1TBY

It only seems fair, since I couldn't say in advance who last month's speaker would be, to thank Jim, **WA1TBY** for his presentation on traffic handling and the National Traffic System. Jim was a very pleasant speaker and came prepared with lots of handouts, and an activity to go along with his talk. By now, the radiograms that were originated at the talk should have been delivered.

Volunteers sought to teach ham class

A side benefit of operating public events is that hams, normally invisible to the public, briefly become accessible. At the Groton Road Race, we got a request from a teacher in the Groton school system to teach a licensing class. This is a great opportunity! See **Earl Russell, WR1Y** for details.

Public Service Log

Groton Road Race Errata

Extra Special Thanks to:

N1OMM	Scott Pozerski
WA1TAC	Rodney Hersh
W1FKW	Caldwell Smith
W1LHT	Mike Cantwell
	Bronwen Wallens
	James Triehy

who inadvertently got dropped from the list of people who helped at the Groton Road Race. Sorry for the omission.

Next time you're in D.C.

By Stan, KD1LE

Did you know you can be an exhibit at the Smithsonian Museum of American History in Washington, D. C.? The museum has an amateur station available for use by licensed hams. It is located in the Information Age Display on the first floor of the west wing. It's an actual exhibit. You must make advanced reservations with the museum to operate the station.

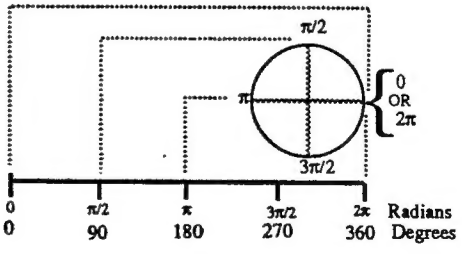
"Of Course It Makes Sense"

by Russ, WR1Y

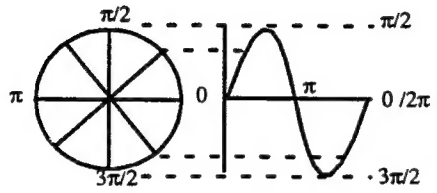
What is ***IMPEDANCE***? What do you mean by ***PHASE LAG*** or ***PHASE LEAD***?

Nature adores a ***SINE WAVE***. Any electrical wave form can be reduced to a combination of simple sine waves with distinct ***AMPLITUDE*** and ***PHASE***. So What?

Take a CIRCLE and lay its CIRCUMFERENCE along the page as the base of a graph or more properly the X-AXIS. The circumference of a circle is 2π times the radius so that becomes the magnitude of our base line. It means that the RADIUS bent around on the circumference will go 2π times. When we use the radius term to describe rotation in electricity we call it a ***RADIAN of PHASE ROTATION***. Don't stop, this is just for definition and I promise it gets easier from here. Look at the graphs and try to understand where they came from.



Taking our graph with a base line of 2π RADIANS we can transfer the value of the amplitude of our CIRCLE to the vertical axis (Y AXIS) or the height above and below the horizontal diameter. That's just the line where we chose to start and end our rotation. Check the picture, it makes sense. This is the fabled SINE WAVE. It rotates through 2π RADIANS of PHASE per revolution. We could have used 360 Degrees instead of 2πR and as long as we kept the same convention through all of our calculations the answers would be OK.



2πR is much easier to work with being natural expression of a circle (though not, perhaps, to a lot of you -- yet.) Now that we have decided to use RADIANS as a measure of ***PHASE ROTATION*** we can drop the R and just say there are 2π RADIANS of PHASE change in one ***CYCLE*** (circle) of a SINE WAVE of electrical energy. One RADIAN is about 57.3 Degrees but I'll never mention that again.

OK

If PHASE changes 2π RADIANS per CYCLE, and the FREQUENCY of our signal is (f) CYCLES per SECOND, then the RATE at which PHASE changes is 2π (one sine wave of phase change) times the FREQUENCY (number of sine waves per second). This term (2πf) is given the lower-case Greek letter ***Omega*** (ω). So again, the RATE at which the PHASE of a signal in RADIANS is changing is called Omega and it is the product of the number of RADIANS in a SINE WAVE and the number of SINE WAVES per second.

$$\omega = 2\pi f$$

Why should we care about this? Well, it just so happens that capacitors and inductors don't exist if the signal across their terminals is not changing PHASE. They cease to exist at DIRECT CURRENT. OK, they're still there but they have no value of ***reactance***. The reactance (reaction to) of a CAPACITOR (C) or an INDUCTOR (L) is a function of the RATE of change of the PHASE across its terminals.

SAY AGAIN?

The more rapid the PHASE change the more the capacitor (C) and the INDUCTOR (L) will REACT to the signal across its terminals. Actually, the relationship between REACTANCE and FREQUENCY is pretty simple at this point. The REACTANCE of an INDUCTOR called ***INDUCTIVE REACTANCE*** is simply:

$$X_L = \omega L$$

Where:

- X_L is the INDUCTIVE REACTANCE in OHMS
- ω is $2\pi f$
- **L** is INDUCTANCE in HENRIES

The INDUCTANCE value is based on the material on which the coil is wound, the number of turns of wire, and the physical dimensions.

So how about the CAPACITOR? Pretty much the same except the REACTANCE of a CAPACITOR is an inverse function of the rate of PHASE change. All that means is that:

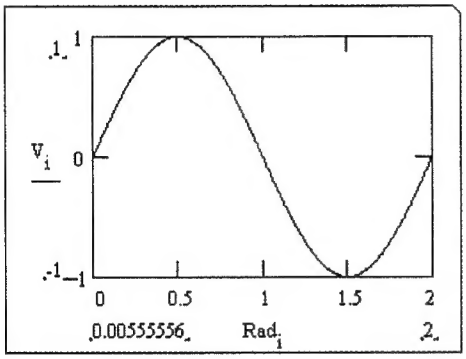
$$X_C = 1/\omega C$$

Where:

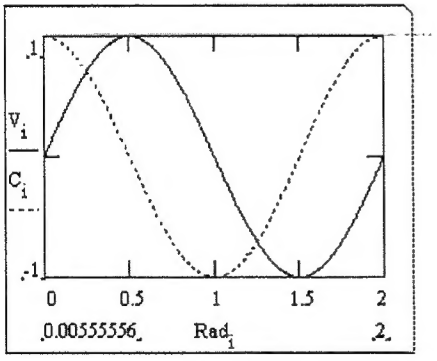
- X_C is the ***CAPACITIVE REACTANCE*** in OHMS
- ω is $2\pi f$
- **C** is the CAPACITY in FARADS

CAPACITY value is based on the size of the opposing plates, their spacing, and the ***DIELECTRIC CONSTANT*** of the material between them. (We'll do DIELECTRIC CONSTANT in a later article, so don't worry about it now.)

The build up of the CHARGE in a CAPACITOR is caused by CURRENT FLOW charging the opposing plates. This CURRENT FLOW is proportional to the RATE of change of the VOLTAGE impressed across its terminals. Not the VALUE of the VOLTAGE:----the RATE of CHANGE. Let's take a look at our SINE WAVE again,



The RATE of CHANGE of the VOLTAGE is the SLOPE of the curve. The STEEPER the SLOPE, the faster the VOLTAGE is changing. If the VOLTAGE CHANGE is maximum as seen on the curve at 0 and Pi then the CURRENT must be MAXIMUM at these points. This is what we see when we plot this on our simple SINE WAVE graph.



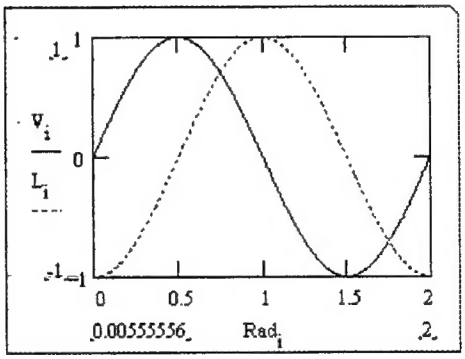
SON OF A GUN! The CURRENT does LEAD the VOLTAGE in a CAPACITOR by $\pi/2$ RADIANS (90 Deg.) when we impress a signal varying in PHASE at a SINUSOIDAL RATE (voltage sine wave). To express this

mathematically we affix the operator -J to the term.

$$X_C = 1/-j\omega C$$

Don't sweat the operator now, we'll cover it in detail later. It just means that the CAPACITIVE REACTANCE appears at the $3\pi/2$ (270 Deg.) point on the POLAR PLOT we're going to create in a bit. Later on it will allow manipulations of complex circuits with resistive and reactive components. It's a helpful MATH tool.

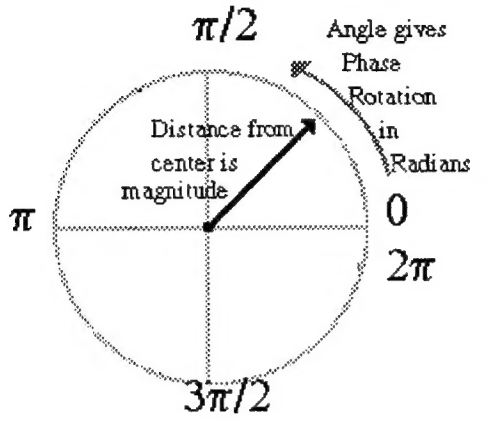
Let's go through the same thought process for INDUCTIVE REACTANCE. An INDUCTOR creates a MAGNETIC FIELD when CURRENT is drawn through the winding. An INDUCTOR resists any change to its MAGNETIC FIELD. The INDUCTOR works so hard to maintain its MAGNETIC FIELD, that it actually creates a voltage to fight the change, resulting in the CURRENT being MAXIMUM in the NEGATIVE direction at the highest VOLTAGE RATE of CHANGE. Back to our graph.



WILL YOU LOOK AT THAT! The CURRENT LAGS the VOLTAGE by $\pi/2$ RADIANS (90 Deg.). Again its convenient to assign a rotation operator to this term and we use +J. We don't really use the plus sign as it is assumed and we just say:

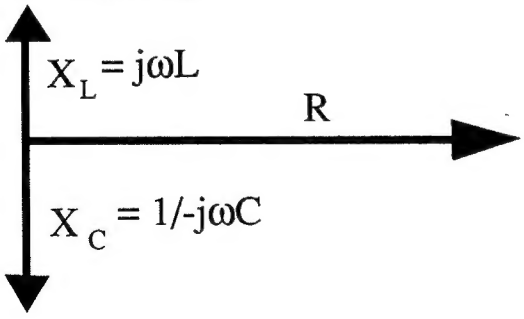
$$X_L = j\omega L$$

If we use a standard POLAR PLOT (we'll draw it next) the position of the INDUCTIVE REACTANCE will be at $\pi/2$ (90 Deg.). A POLAR PLOT is a graph in which the MAGNITUDE of the function we are plotting is shown as the RADIUS of the circle while the PHASE SHIFT (remember that?) of the function is shown in ROTATION about the center (origin) of the circle. It looks like this:



In our case we will plot the numerical value of X_L, X_C, and **R** in their proper position on the POLAR PLOT. We won't spend much time on RESISTANCE except to say it is the same whether we are using DIRECT CURRENT or our SINE WAVE. The CURRENT is proportional to the VOLTAGE in keeping with OHMS LAW. The CURRENT and VOLTAGE are in PHASE and there is no rotational operator (the J's we used in the reactances).

Let's put our REACTANCES and RESISTANCE on our new POLAR PLOT where they belong.



Do you notice the peculiar relationship between X_L and X_C? WOW, they're in opposite directions on our polar plot. Does that mean that they cancel each other?

STAY TUNED

--Russ

N.B. -- for you math people, "j" is the same as "i" and is the square root of a negative 1. Electrical Engineers use "j" because "i" is instantaneous current in electrical talk.

Classified Ads

Classified ad deadline is the first Thursday of the month. Member ads are published free subject to space available and reasonability guidelines which are set at the whim of the editor.

FOR SALE: Ten-Tec Triton IV Transceiver, power supply with speaker, remote VFO, MFJ artificial ground, desk mike, dummy load and ammeter. $450.
-- Don Spencer, N1LVG, (508) 263-7660

Upcoming Events

15 - 16 May

Armed Forces Day

From 9am EDT Saturday to 4pm EDT Sunday. Military stations will transmit on military frequencies and listen on ham frequencies. Each military station will QSL separately. Special receiving test requires ham/SWL stations to receive message from Secretary of Defense in CW or RTTY. Details too numerous for newsletter -- see QST.

16 May

Memphis Belle Special Event Station

From 9am to 9pm EDT. Event celebrates last mission of the bomber Memphis Belle. Operations on **28.455, 21.320, 14.305**. QSL to Memphis Belle c/o DARC, P.O. Box 16343, Memphis TN 38186-0343

18 - 22 May

Texas Star Party Special Event Station

Amateurs at the Texas Star Party (astronomy event) will be operating **K5GH** ("K-5-Galaxy Hunters"). Frequencies (+/- QRM) **28.365, 21.365, 14.265, 7.265 MHz.** SSTV and CW contacts on request. Commemorative QSL via K5GH-TSP, 2619 Bordeaux, McKinney TX 75070

18 - 20 June

E.F. Johnson Special Event Station

The Viking Amateur Radio Society of Waseca MN will be celebrating the 70th anniversary of the E.F. Johnson Co. They have asked for special permission to use the call sign **9ALD**, which was E.F. Johnson's (the person) call. If that is not granted, they will operate under the call **WA0CJU.** Operation planned on "non-WARC" bands 160 - 10.

25-26 June

Field Day

Need I say more?

Saturday 24 July

ARRL New England Division Convention.

At Center of New Hampshire Convention Center in Manchester, NH. Flea market, license exams, DXCC and WAS field QSL checking, forums for Contesting, DX, Packet and ARRL. 8:00 am to 4:30 PM. Admission $4.00 in advance $5.00 at the door.

HOW COPY?

Let's talk about Special Event Stations. I stuck a few interesting ones in the newsletter this time around. They're not up there with DX hunting or contesting for most hams, but they're a lot of fun. My first ever QSO was with a special event station. I picked it because it wasn't as intimidating as DX and I knew they'd QSL.

Special event stations are special for other reasons too. Almost always they're operated on a shoe-string, yet they print up special QS Ls or certificates and always QSL as long as you send an SASE (and sometimes even if you don't.) The QS Ls are generally above average in terms of hang-on-the-wall-ability. This means that they represent something real special to the operators and those guys want to share that special thing with you.

Another fun thing to do is work the Armed Forces Day stations. On AFD, you operate split; the military stations transmit in their

frequency allocation and listen to the hams in the ham bands. If you send your QSL as a post card, you'll get a QSL in return. Usually these cards aren't the flashiest in the world, but they're interesting. If you manage to copy the Secretary of Defense's message either on CW or RTTY, you can get a 'Certificate of Merit' to hang on the wall.

--KC1TD

NVARC

Nashoba Valley Amateur Radio Club

Officers:

President: Earl Russel, WR1Y
Vice-President: Bruce Blain, K1BG
Treasurer: Ben Akins, KB1FJ
Secretary: Duane Long, KD1JY

The Nashoba Valley Amateur Radio Club meets on the third Thursday of each month at the Pepperell VFW hall, 7:30pm. Annual membership $15. Special ratee for families and under 16.

Articles for NVARC Signal are always welcome. Preferred format is plain text on 3.5-inch IBM floppy, though the editor is happy to accept anything from phone calls to skethes on cocktail napkins. Send to:

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